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ABSTRACT

The main objective of the third National Education Goal is for all students to be competent in academic subject matter, while the fifth National Education Goal aims for U.S. students to be able to perform at world-class levels in mathematics and science. This report summarizes the progress each state has made toward Goal 3--the students' achievement and citizenship goal, and Goal 5--the mathematics and science goal, with particular emphasis placed on mathematics and science achievements in Colorado. It is concluded that the majority of states participating in National Assessment of Educational Progress (NAEP) assessments have made progress toward Goal 3 in mathematics. (ASK)

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Mathematics and Science Achievement in Colorado, 1998

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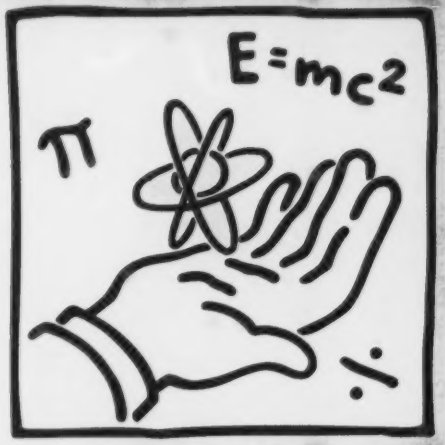
Goal 3: Student Achievement and Citizenship

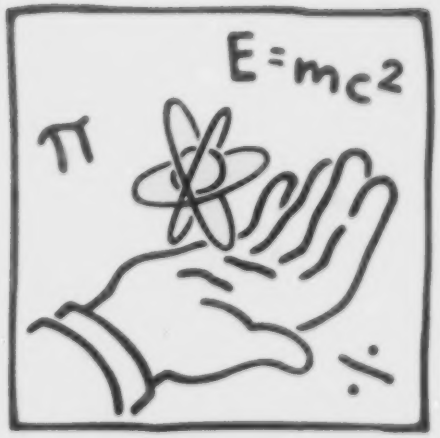


Goal 5: Mathematics and Science

The National Education Goals Panel

Mathematics and Science Achievement in Colorado, 1998

Goal 3: Student Achievement and Citizenship



Goal 5: Mathematics and Science

The National Education Goals Panel

National Education Goals Panel

The National Education Goals Panel (NEGP) is a unique bipartisan and intergovernmental body of federal and state officials created in July 1990 to assess and report state and national progress toward achieving the National Education Goals. In 1994, the Goals Panel became a fully independent federal agency charged with monitoring and speeding progress toward the eight National Education Goals. Under the legislation, the Panel is charged with a variety of responsibilities to support systemwide reform, including:

- reporting on national and state progress toward the Goals over a 10-year period;
- working to establish a system of high academic standards and assessments;
- identifying promising practices for improving education; and
- building a nationwide, bipartisan consensus to achieve the Goals.

Panel members include eight Governors, four members of Congress, four state legislators, and two members appointed by the President.

This state report is a condensed version of *Mathematics and Science Achievement State by State, 1998*, which includes four pages of information for the United States, each state, the District of Columbia, and five U.S. territories. Please provide any comments you may have about this report by using the response card in the back of this document.

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Goal 3 and Goal 5

Goal 3 *Student Achievement and Citizenship*

By the year 2000, all students will leave grades 4, 8, and 12 having demonstrated competency over challenging subject matter including English, mathematics, science, foreign languages, civics and government, economics, arts, history, and geography, and every school in America will ensure that all students learn to use their minds well, so they may be prepared for responsible citizenship, further learning, and productive employment in our Nation's modern economy.

Objectives:

- The academic performance of all students at the elementary and secondary level will increase significantly in every quartile, and the distribution of minority students in each quartile will more closely reflect the student population as a whole.
- The percentage of all students who demonstrate the ability to reason, solve problems, apply knowledge, and write and communicate effectively will increase substantially.
- All students will be involved in activities that promote and demonstrate good citizenship, good health, community service, and personal responsibility.
- All students will have access to physical education and health education to ensure they are healthy and fit.
- The percentage of all students who are competent in more than one language will substantially increase.
- All students will be knowledgeable about the diverse cultural heritage of this Nation and about the world community.

Goal 5 *Mathematics and Science*

By the year 2000, United States students will be first in the world in mathematics and science achievement.

Objectives:

- Mathematics and science education, including the metric system of measurement, will be strengthened throughout the system, especially in the early grades.
- The number of teachers with a substantive background in mathematics and science, including the metric system of measurement, will increase by 50 percent.
- The number of United States undergraduate and graduate students, especially women and minorities, who complete degrees in mathematics, science, and engineering will increase significantly.

Foreword

A Special Message to the Citizens of Colorado from Governor Roy Romer

Fellow Coloradan:

As Governor of Colorado, I've spent the past 12 years working to improve the education system of our state. During that time, I've heard endless arguments over everything from cafeteria purchases to corporal punishment. But amid all the debate, there's one question I keep coming back to: What do our students know, and what are they able to do?

That's a question to which every parent – and every student – in Colorado deserves an answer. Indeed, the success of our education system demands one.

This report represents a start. The data contained here reflect Colorado 4th and 8th graders' progress on the National Assessment of Educational Progress (NAEP) – the nation's "report card." NAEP is a rigorous set of tests in several academic areas, including reading, writing, mathematics, and science. Proficiency on the NAEP tests indicates a student's mastery of what national experts agree he or she should know and be able to do.

What distinguishes NAEP from other tests? There are at least three important differences:

(1) NAEP measures groups, not individuals. Unlike most tests, NAEP is administered in separate sections; no single student takes the entire assessment. Every two years, NAEP assesses nationally representative samples of more than 120,000 students in public and private schools in Grades 4, 8, and 12. NAEP state assessment samples also include enough public school students to reflect the mix in each participating state.

(2) NAEP compares students' performance to a set of agreed-upon expectations or standards, not "norms." This is critical. What we need to know is whether students have mastered the key material or skills in a given subject, not simply where they stand in relation to other students. That's the essential difference between a standards-based assessment and a norm-referenced test.

(3) NAEP is national. In fact, NAEP is the only nationwide test of its kind. That's important, because while it's useful to know how Colorado's children perform on our own state tests,* a national frame of reference is just as valuable. As parents and as educators, we need to know whether the standards we're asking our students to meet are as high as those in other states.

With those distinctions in mind, let me try to summarize the findings in this report:

Gains in math. As you can see, Colorado has boosted its NAEP scores in 4th and 8th grade mathematics – making us one of only six states in the nation to win two "gold stars" for academic improvement.

- In 4th grade mathematics, the percentage of Colorado students meeting or exceeding NAEP's definition of "proficiency" rose from 17% in 1992 to 22% in 1996. Only two states in the nation had significantly higher percentages of students at or above proficiency.
- In 8th grade mathematics, the percentage of our students at or above proficiency rose from 17% in 1990 to 25% in 1996. Only eight states in the nation registered significantly higher proportions.

High marks in science.

- In 8th grade science (administered at the state level for the first time in 1996), 32% of Colorado students scored at or above proficiency. Only four states in the nation fared significantly better.

International standings. How do Coloradans compare to students around the world? New research, using the NAEP scores and the Third International Mathematics and Science Study (TIMSS), shows world-class performance in science and room for improvement in mathematics.

- In 8th grade mathematics, Coloradans would be expected to fall roughly in the middle of the international pack: 14 of the 41

* The National Assessment of Educational Progress differs from Colorado's own standards-based assessments, the Colorado Student Assessment Program (CSAP). CSAP, whose first assessment of 4th grade reading and writing was released last year, uses a different set of standards than NAEP.

Foreword

countries participating in TIMSS would be expected to outperform us. In mathematics, this research indicates, Colorado's 8th graders would be expected to perform as well as their counterparts in Canada, England, Germany, and the Russian Federation.

- In 8th grade science, however, Colorado shines. Colorado was one of 14 states awarded a gold star for "world-class performance" in 8th grade science. Only one country (Singapore) would be expected to outperform us. Eighth graders in Colorado would be expected to handle science as well as those in Canada, England, Germany, Japan, Korea, and the Russian Federation – and better than those in France and Hong Kong.

Only one other state (Connecticut) was awarded as many stars as Colorado.

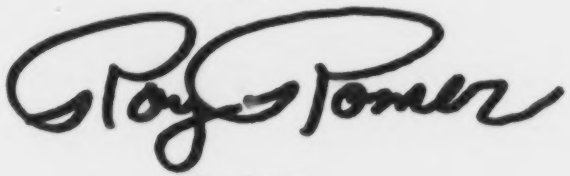
In conclusion, let me make three points.

First, much of this report is good news. Colorado's students are doing significantly better in mathematics than they've done before, and 8th graders would be expected to do as well in science as most students around the world. Our progress in these key academic areas is a credit to the hard work of students and teachers alike, and should serve as an incentive for continued improvement.

Second, neither Coloradans nor Americans in general are doing as well as they should be. As this report shows, only one out of four students in Colorado knows what he or she needs to know in mathematics; and only one out of three has demonstrated proficiency in science. The national averages are not much different: 21% have demonstrated proficiency in 4th grade mathematics, 24% in 8th grade mathematics, and 29% in 8th grade science. Those figures are simply unacceptable; we have to do better.

But finally, even where the results are not as promising, we're better off having this information – and using it, to focus our educational efforts and improve the performance of all students – than not having it at all. We'll never get where we need to be if we don't know where we are. That's what standards and assessments like these are all about.

Sincerely,



Roy Romer
Governor of Colorado

Data Highlights

Colorado

The aim of the third National Education Goal is that all students will be competent in academic subject matter. State-level results from the National Assessment of Educational Progress, or NAEP, indicate that Colorado has made progress toward this Goal in mathematics.

The aim of the fifth National Education Goal is that U.S. students will achieve world-class levels of performance in mathematics and science achievement. Based on their NAEP scores, 14 states would be expected to achieve this level of performance in science, including Colorado.

- Colorado was one of six states awarded two gold stars by the National Education Goals Panel for improvement over time in both 4th grade and 8th grade mathematics:

1. Colorado
2. Connecticut
3. Indiana
4. North Carolina
5. Texas
6. West Virginia

- Colorado was also one of 14 states awarded a gold star by the National Education Goals Panel for world-class performance in 8th grade science achievement:

1. Colorado
2. Connecticut
3. Iowa
4. Maine
5. Massachusetts
6. Minnesota
7. Montana
8. Nebraska
9. North Dakota
10. Oregon
11. Utah
12. Vermont
13. Wisconsin
14. Wyoming

- Only one other state – Connecticut – was awarded as many stars as Colorado.

- The National Education Goals Panel has set its performance standard at the two highest levels of achievement – Proficient or Advanced – on the National Assessment of Educational Progress, or NAEP. In 1996, the percentages of public school students in Colorado who met this standard were:

  - 22% in 4th grade mathematics;
  - 25% in 8th grade mathematics; and
  - 32% in 8th grade science.

- When compared with other states, Colorado's public school students placed near the top in both mathematics and science achievement. Only a handful of states had significantly higher percentages of students who scored at or above Proficient on the 1996 NAEP assessments:

  - only 2 states in 4th grade mathematics;
  - only 8 states in 8th grade mathematics; and
  - only 4 states in 8th grade science.

- A new research study that uses NAEP scores to predict how states would compare to 41 nations that participated in the Third International Mathematics and Science Study (TIMSS) places Colorado's performance in the middle in mathematics, but at a world-class level of performance in science:

  - Fourteen of the 41 participating nations would be expected to outperform Colorado's 8th graders in mathematics. Colorado would be expected to perform as well as Canada, England, Germany, the Russian Federation, and the United States.

  - Only 1 of the 41 participating nations – Singapore – would be expected to outperform Colorado's 8th graders in science, however. Colorado would be expected to perform as well as Canada, England, Germany, Japan, Korea, the Russian Federation, and the United States, and better than France and Hong Kong.

Introduction

Although all of the National Education Goals are important, the two that focus on raising student academic achievement – Goals 3 and 5 – are considered by many to be the nation's highest education priorities. Goal 3 calls for all students to demonstrate competency over challenging subject matter, while Goal 5 calls for U.S. students to be first in the world in mathematics and science achievement.

State policymakers need good information to help them monitor their state's progress toward these Goals. First, policymakers need to know whether student achievement is increasing over time, so that they can determine whether educational programs and policies are having the desired effect. Second, policymakers need to be able to benchmark their state against other states and countries to see how their students' academic performance compares to the best in the nation and the best in the world. Third, policymakers need to know how different groups of students are performing academically, so that they can target educational services appropriately.

This report provides all three types of information. Its purpose is to summarize the amount of progress that Colorado has made in raising student academic achievement in mathematics and science since the National Education Goals were established in 1990.

Report format

This report contains four pages of information for Colorado (see pp. 10-13). The first three pages measure progress toward Goal 3, using student achievement data from the National Assessment of Educational Progress (NAEP). NAEP was authorized by Congress in 1969, and is the only nationally representative and ongoing assessment that measures what students know and are able to do in different subject areas. Congress expanded NAEP to allow the reporting of comparable state-by-state results, beginning with the 1990 mathematics assessment. Participation in state-level NAEP is voluntary, and has increased from 40 states and territories in 1990 to 45 in 1996.

NAEP results are reported in mathematics (Grades 4 and 8) and science (Grade 8). Thus far, these are the only grades in which NAEP mathematics and science assessments have been administered at the state level. Since 1990, mathematics has been assessed twice at Grade 4 (in 1992 and 1996) and three times at Grade 8 (in 1990, 1992, and 1996). Science has been assessed once (in 1996).

The first three pages of data show:

- how much progress Colorado has made over time;
- how the state's latest academic performance compares to that of the United States and other states;[1] and
- how different subgroups of students in the state performed on the most recent NAEP assessment.

The National Education Goals Panel awards gold stars to states that have shown a significant increase in the percentage of students in their state who meet the National Education Goals Panel's performance standard.[2] The Goals Panel's performance standard is based on three achievement levels set by the National Assessment Governing Board to describe the quality of student achievement on NAEP: Basic, Proficient, and Advanced. The Basic level represents partial mastery of necessary knowledge and skills; the Proficient level represents solid academic performance; and the Advanced level represents superior performance.[3] The Goals Panel has set its performance standard at the Proficient or Advanced levels on NAEP. The Goals Panel considers performance at these two highest levels as evidence that students have demonstrated competency over challenging subject matter.

The fourth page of data shows how close Colorado is to achieving Goal 5 (see p. 13). Although Goal 5 calls for the United States – not each individual state – to be first in the world in mathematics and science, the majority of states must be at world-class levels of performance in mathematics and science if we expect the nation to attain first-in-the-world status. International comparisons of student achievement in 8th grade mathematics and science are presented, using data from a newly released research study.[4] This study statistically links state results from the 1996 NAEP with country results

1. The term "state" is used hereafter in this report to refer to the 50 states, the District of Columbia, and the territories.
2. In this report, "significance" refers to statistical significance and indicates that the observed differences are not likely to have occurred by chance. All differences in this report that are termed "statistically significant" are measured at the 0.05 level.
3. Bourque, M.L., Champagne, A.B., & Crissman, S. (1997, October). *1996 Science performance standards: Achievement results for the nation and the states*. Washington, DC: National Assessment Governing Board.
4. Johnson, E.G., & Siegendorf, A. (1998, May). *Linking the National Assessment of Educational Progress and the Third International Mathematics and Science Study: Eighth grade results*. Report prepared for the U.S. Department of Education, National Center for Education Statistics, NCES 98-500. Washington, DC: U.S. Government Printing Office.

from the 1995 Third International Mathematics and Science Study (TIMSS). TIMSS is the most comprehensive international study of mathematics and science achievement conducted to date. TIMSS tested half a million students in 41 countries in 30 different languages. Participating countries included the United States, as well as some of the United States' chief economic competitors and trading partners, such as Japan, Germany, Canada, Korea, Singapore, Hong Kong, and the Russian Federation.

Linking the two assessments allows us to predict how each state would have performed on TIMSS, relative to the 41 countries that actually participated in the international assessment, on the basis of each state's NAEP performance. The authors of the linking study caution that the technique used to link the two tests can provide only limited information, since NAEP and TIMSS cover different content and were taken by different groups of students at different times. Nevertheless, the technique can provide broad comparisons that tell states which countries' students would be expected to score significantly higher than, similar to, or significantly lower than their own students in mathematics and science on this international assessment. In this report, gold stars signifying "world-class performance" are awarded to those states that would be expected to score as well as, or better than, 40 or more of the 41 participating TIMSS nations in mathematics or science.

Value to states

This report shows three of the ways in which NAEP data can be a valuable source of information for states:

1. **NAEP can be used to monitor educational progress over time.**

One of the most common uses of NAEP is to monitor trends in academic performance to see whether student achievement is improving over time. This is possible because NAEP is designed to repeat assessments in each subject area at least every four years. This feature enables policymakers to answer questions such as: Has student performance improved since my state established new statewide standards in science? Are more 8th graders in my state considered Proficient in mathematics since my state began requiring all 8th graders to take algebra?

__Improvement Over Time__ is presented in Part 1 on pp. 10-12. The percentages of Colorado's students who scored at or above the Proficient level on NAEP mathematics and science assessments will be tracked over a ten-year period, from the establishment of the National Education Goals in 1990, until the year 2000.

2. **NAEP can be used to benchmark state performance against the best in the nation and the best in the world.**

Because NAEP scores are comparable across states, policymakers can use NAEP to answer questions such as: How does my state compare to neighboring states or to the highest-performing states in the country?[5] It is also possible to use NAEP scores in a more limited way to predict relative performance on a related assessment such as TIMSS, so that states can benchmark their performance against top-performing nations in mathematics and science. Policymakers can use results from the NAEP/TIMSS linking study to answer questions such as: How many nations would be expected to outperform my state in 8th grade mathematics? How would my state be expected to perform in comparison to the United States' major trading partners in 8th grade science?

__State Comparisons__ are presented in Part 2 on pp. 10-12. Colorado's performance is compared to the nation and to other states on the most recent NAEP mathematics and science assessments.

__International Comparisons__ are presented on p. 13. Colorado's predicted performance on TIMSS is compared to the actual performance of the 41 participating TIMSS nations. Countries are clustered in alphabetical order in three groups: those that would be expected to perform significantly higher than, significantly lower than, or not significantly different from Colorado in 8th grade mathematics and science.

3. **NAEP can be used to monitor whether all groups of students in a state are achieving at high levels.**

Goal 3 specifies that all students will demonstrate competency over challenging subject matter. Because NAEP data can be broken out by subgroups, policymakers can use NAEP to answer questions such as: Are similar

[5] Although NAEP scores are comparable, the reader should bear in mind that many variables of interest to state policymakers can contribute to differences in state performance, such as available resources, curricula, educational practices, etc. The results presented in this report do not control for these variables.

proportions of boys and girls in my state considered Proficient in mathematics and science? Do minority students score as well as White students? Do large achievement gaps exist between urban and non-urban students?

> *Subgroup Performance is presented in Part 3 on pp. 10-12. This section shows how many students in different subgroups in Colorado scored at or above the Proficient level on the most recent NAEP mathematics and science assessments. Results are presented by sex, race/ethnicity, parents' highest level of education, school location, and eligibility for free/reduced-price lunch programs.*

Interpreting the results

NAEP is a large-scale assessment intended for monitoring trends in student performance and is not administered to every student. Instead, samples of students are selected to take the test. This enables states to use smaller, cost-efficient samples to predict how the entire student population would have performed on an assessment without testing all of them. This is similar to a public opinion poll that predicts, with a certain degree of confidence, how all individuals would have responded to a set of questions had they all been polled.

It is important to note that any estimate based on a sample, whether it is from a NAEP assessment or a public opinion poll, contains a small amount of error. The estimate would be slightly higher or slightly lower if a different sample were chosen. Public opinion polls account for this error when they caution that their results are "accurate within plus or minus two percentage points." In the same way, we must account for the uncertainty in NAEP results, whether we are comparing progress over time, performance among states, or performance among subgroups of students within a state.

We account for the uncertainty by using a formula to calculate a standard error for each estimate.[6] The standard error tells us how precise the estimate is. The closer the standard error is to zero, the more precise the estimate. Although sample size is only one of several factors that influence the size of the standard error, as a general rule, larger samples yield more precise estimates and smaller standard errors.

If we want to examine differences between groups – for example, to determine whether one state performed at a higher level than another did – we must apply a statistical test to tell us whether there are likely to be differences in actual performance between groups in the entire population. The statistical test takes into account the size of the standard errors for each group's score, as well as the difference between the scores. If the test indicates that the groups in the entire population are likely to perform differently, we say that the difference is statistically significant. This means that the differences are not likely to have occurred by chance – we can be confident that performance has changed over time or one group has outperformed another.

This should be kept in mind when reviewing the data on pp. 10-12. In Part 2, for example, it may appear that one state outperformed another because the percentage of students who met the Goals Panel's performance standard in the first state is higher. However, the percentages may not be statistically different because each percentage is an estimate that has some uncertainty associated with it. For this reason, it would not be accurate to rank individual states strictly by the percentages of students who scored at or above Proficient. Instead of ranking individual states, it is more useful to talk about states' performance in terms of clusters of states that performed significantly higher than, significantly lower than, or not significantly different from a particular state.

Similarly, in Part 3, it would not be accurate to conclude that one subgroup of students outperformed another based solely on the percentages listed on the graph. An observed difference of 3 percentage points between males and females, for example, may not be statistically significant when standard errors are taken into account. In order to keep the graphs in Part 3 as clear and as readable as possible, we have not attempted to flag subgroup differences on the graphs themselves. Instead, statistically significant differences between subgroups are summarized on p. 14.

Finally, readers should use caution when interpreting the results of the NAEP/TIMSS linking study on p. 13. The purpose of the linking study is to compare states to nations, not states to states or nations to nations. State-to-state comparisons, using comparable NAEP data, appear in Part 2 on pp. 10-12. Because the results of the NAEP/TIMSS linking study can offer only approximate comparisons of performance of individual states relative to the 41 participating TIMSS nations, nations are simply listed in alphabetical order and actual scores are not shown.[7]

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[6] For more detailed information, see the National Education Goals Panel's full report, *Mathematics and Science Achievement State by State, 1998*. See also the Technical Report of the NAEP 1996 State Assessment Program in Mathematics.

[7] For more detailed technical information about the NAEP/TIMSS linking study, see the forthcoming report from the National Center for Education Statistics, *Linking the National Assessment of Educational Progress and the Third International Mathematics and Science Study at the eighth grade: A research report.*

Findings — Improvement Over Time

The percentage of students who met the Goals Panel's performance standard (that is, a score at or above Proficient on NAEP) increased significantly during the 1990s:

- nationally and in 7 states in 4th grade mathematics; and
- nationally and in 27 states in 8th grade mathematics.

In no state has achievement declined by an amount that is statistically significant.

The 28 states that earned stars for improvement over time are shown on the map in Figure 1. At present, the maximum number of stars that a state can earn for improvement in student academic achievement is two (in 4th grade mathematics and in 8th grade mathematics). A star for improvement cannot yet be earned in 8th grade science, because NAEP has assessed science only once at the state level.

Twenty-eight states, including Colorado, have earned at least one star (out of a possible two) for improvement over time in mathematics in either Grade 4 or Grade 8:

1. Arizona
2. Arkansas
3. California
4. Colorado
5. Connecticut
6. Delaware
7. Florida
8. Hawaii
9. Indiana
10. Iowa
11. Kentucky
12. Maryland
13. Michigan
14. Minnesota
15. Montana
16. Nebraska
17. New Hampshire
18. New Mexico
19. New York
20. North Carolina
21. North Dakota
22. Oregon
23. Rhode Island
24. Tennessee
25. Texas
26. West Virginia
27. Wisconsin
28. Wyoming

Six of these states, including Colorado, have earned two stars (out of a possible two) for improvement over time in mathematics in both Grade 4 and Grade 8:

1. Colorado
2. Connecticut
3. Indiana
4. North Carolina
5. Texas
6. West Virginia

- ***Seven states that made significant gains in mathematics were also among the highest-performing states* in the nation:***

1. Connecticut
2. Iowa
3. Minnesota
4. Montana
5. Nebraska
6. North Dakota
7. Wisconsin

Findings — State Comparisons

Mathematics — Grade 4

National Performance

In 1996, 21% of U.S. 4th graders in public and nonpublic schools scored at the Proficient level or higher on the NAEP mathematics assessment.

Highest-performing states*	
Connecticut	31%
Minnesota	29%
Maine	27%
Wisconsin	27%

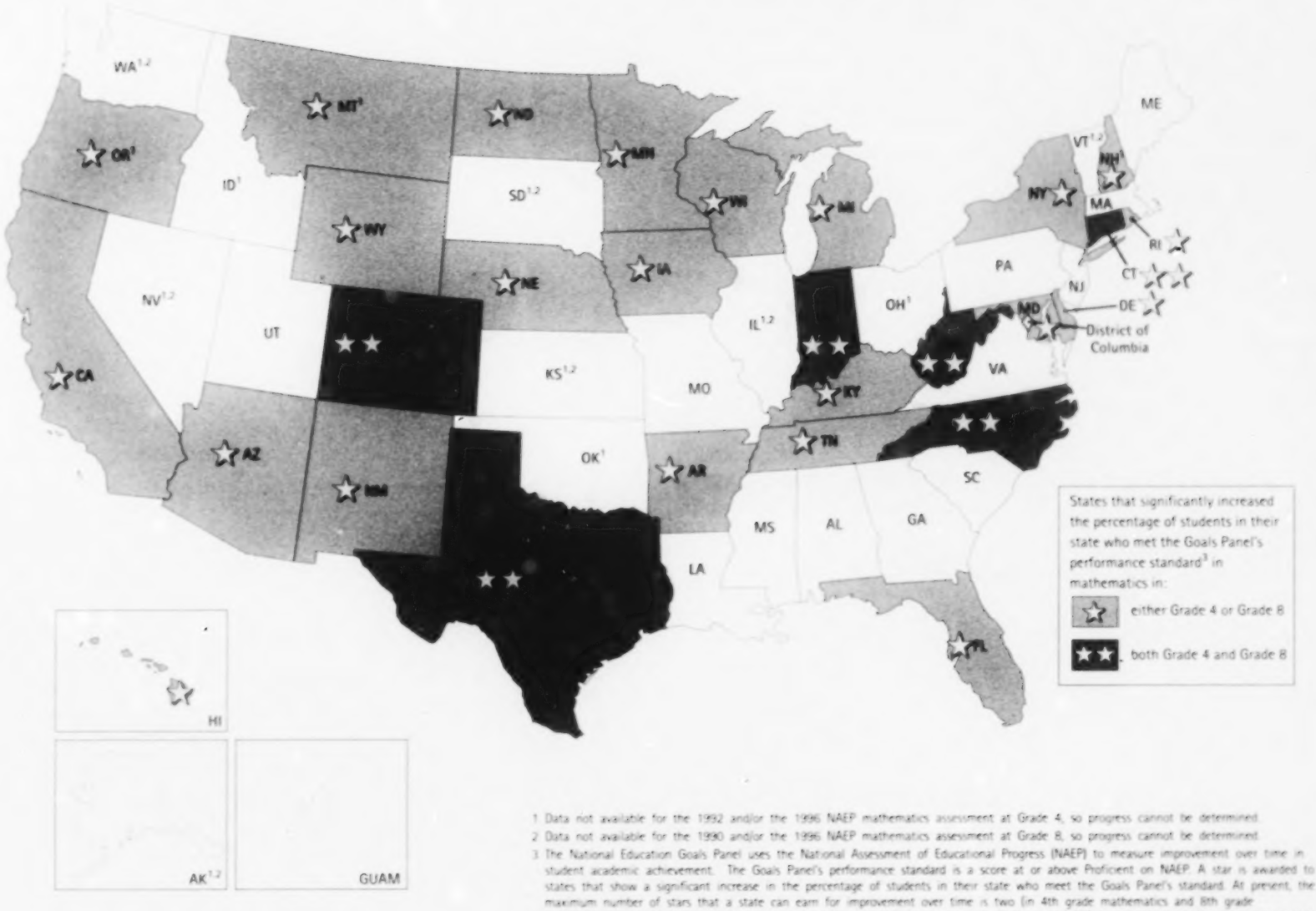
State Performance

In 1996, the percentage of public school 4th graders who scored at the Proficient level or higher on the NAEP mathematics assessment ranged from 3% in the lowest-performing states to 31% in the highest-performing states. In Colorado, 22% met the standard.

* Highest-performing states are defined as those in which the percentage of students who scored at or above Proficient on NAEP was significantly higher than the percentage of students who did so nationally.

State Progress Toward Goal 3: Improvement Over Time in Mathematics and Science Achievement

Figure 1



1 Data not available for the 1992 and/or the 1996 NAEP mathematics assessment at Grade 4, so progress cannot be determined.

2 Data not available for the 1990 and/or the 1996 NAEP mathematics assessment at Grade 8, so progress cannot be determined.

3 The National Education Goals Panel uses the National Assessment of Educational Progress (NAEP) to measure improvement over time in student academic achievement. The Goals Panel's performance standard is a score at or above Proficient on NAEP. A star is awarded to states that show a significant increase in the percentage of students in their state who meet the Goals Panel's standard. At present, the maximum number of stars that a state can earn for improvement over time is two (in 4th grade mathematics and 8th grade mathematics). A star for improvement cannot yet be earned in 8th grade science, because NAEP has assessed science only once at the state level.

Mathematics — Grade 8

National Performance

In 1996, 24% of U.S. 8th graders in public and nonpublic schools scored at the Proficient level or higher on the NAEP mathematics assessment.

State Performance

In 1996, the percentage of public school 8th graders who scored at the Proficient level or higher on the NAEP mathematics assessment ranged from 5% in the lowest-performing states to 34% in the highest-performing states. In Colorado, 25% met the standard.

Highest-performing[*] states	
Minnesota	34%
North Dakota	33%
Montana	32%
Wisconsin	32%
Connecticut	31%
Iowa	31%
Maine	31%
Nebraska	31%
Alaska	30%

Science — Grade 8

National Performance

In 1996, 29% of U.S. 8th graders in public and nonpublic schools scored at the Proficient level or higher on the NAEP science assessment.

State Performance

In 1996, the percentage of public school 8th graders who scored at the Proficient level or higher on the NAEP science assessment ranged from 5% in the lowest-performing states to 41% in the highest-performing states. In Colorado, 32% met the standard.

Highest-performing[*] states	
Maine	41%
Montana	41%
North Dakota	41%
Wisconsin	39%
Massachusetts	37%
Minnesota	37%
Connecticut	36%
Iowa	36%
Nebraska	35%
Wyoming	34%

Findings — Subgroup Performance[§]

Differences by Sex

- Nationally and in 9 out of 45 states, the percentage of male students who scored at or above Proficient in 4th grade mathematics was higher than the percentage of females who did so. There was no significant difference in Colorado.
- In 6 out of 43 states, including Colorado, males outperformed females in 8th grade mathematics. There was no significant difference at the national level.
- In 19 out of 42 states, including Colorado, males outperformed females in 8th grade science. There was no significant difference at the national level.

Differences by Race/Ethnicity

- At the national level, in Colorado, and in most of the other states, there were no significant differences between the percentages of White and Asian/Pacific Islander students who scored at the Proficient level or higher on NAEP.
- However, the percentages of White and Asian/Pacific Islander students who scored at the Proficient level or higher were significantly greater than the percentages of other minority students who met this standard in Colorado. In 4th grade mathematics, 8th grade mathematics, and 8th grade science, Whites and Asians/Pacific Islanders outperformed Blacks and Hispanics. In 4th grade mathematics and in 8th grade science, Whites also outperformed American Indians/Alaskan Natives.

Differences by Parents' Highest Level of Education

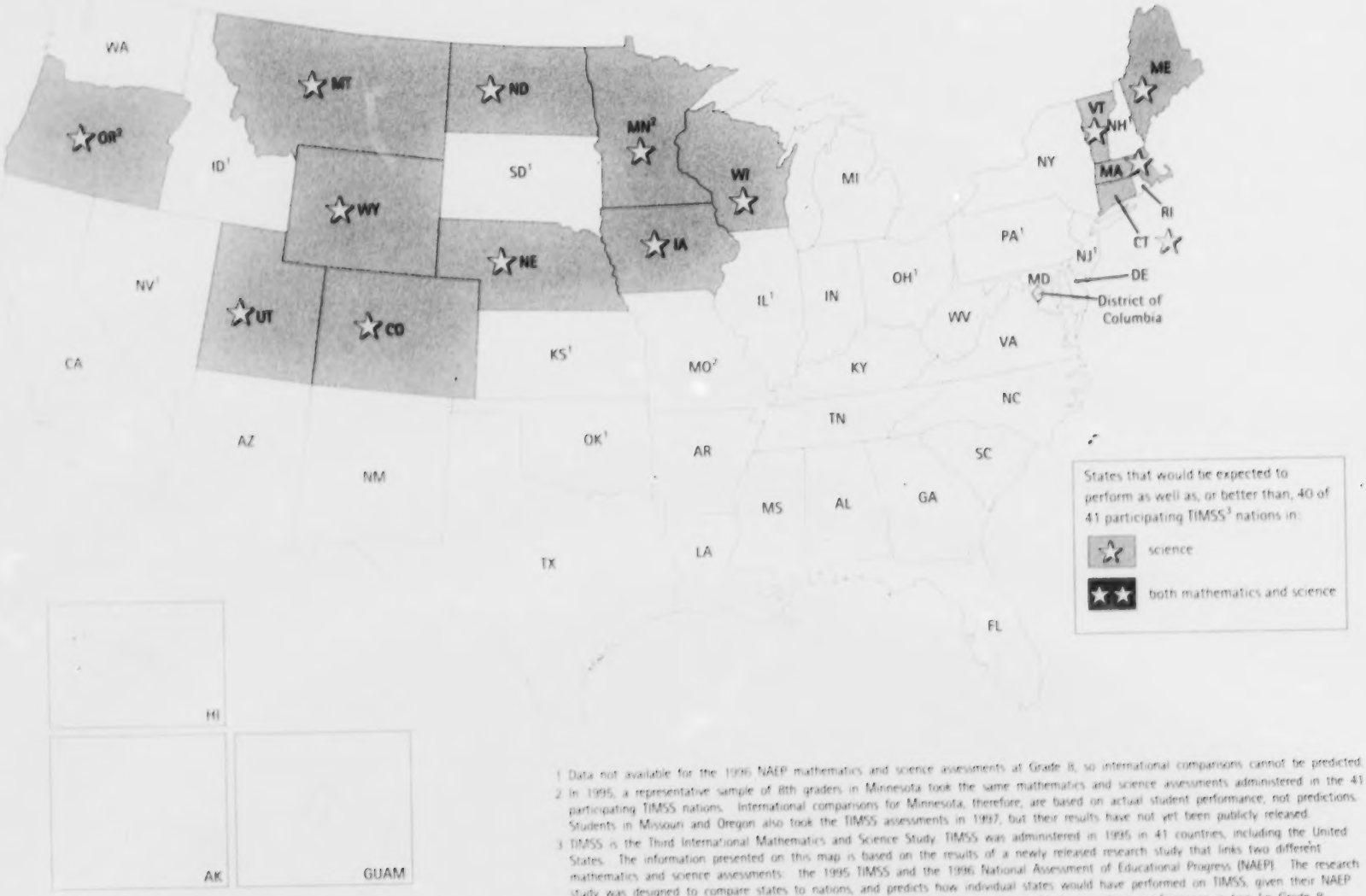
- Nationally, in Colorado, and in almost every other case at the state level, students whose parents had some education beyond high school or whose parents were college graduates outperformed students who reported that neither of their parents had graduated from high school.

[*] Highest-performing states are defined as those in which the percentage of students who scored at or above Proficient on NAEP was significantly higher than the percentage of students who did so nationally.

[§] The reader is cautioned to avoid interpreting subgroup differences in this section of the report as causal relationships.

State Progress Toward Goal 5: World-Class Performance in Mathematics and Science Achievement

Figure 2



1 Data not available for the 1996 NAEP mathematics and science assessments at Grade 8, so international comparisons cannot be predicted.

2 In 1995, a representative sample of 8th graders in Minnesota took the same mathematics and science assessments administered in the 41 participating TIMSS nations. International comparisons for Minnesota, therefore, are based on actual student performance, not predictions. Students in Missouri and Oregon also took the TIMSS assessments in 1997, but their results have not yet been publicly released.

3 TIMSS is the Third International Mathematics and Science Study. TIMSS was administered in 1995 in 41 countries, including the United States. The information presented on this map is based on the results of a newly released research study that links two different mathematics and science assessments: the 1995 TIMSS and the 1996 National Assessment of Educational Progress (NAEP). The research study was designed to compare states to nations, and predicts how individual states would have performed on TIMSS, given their NAEP scores. At present, the maximum number of stars that a state can earn for world-class academic performance is two (in Grade 8 mathematics and Grade 8 science), although no state has earned a star in mathematics.

Differences by School Location

- At the national level, students who attended school in urban fringes/large towns outperformed those who attended school in central cities in 4th and 8th grade mathematics. In Colorado, there were no significant differences in student performance by school location.

Differences by Poverty
(as measured by eligibility for free/reduced-price lunch program)

- In all cases – nationally and in every state – students who were not eligible for the free/reduced-price lunch program outperformed students who were eligible for this program. This was true across all subjects and grades.

Findings – International Comparisons

In 8th grade mathematics, the United States scored higher than 7 countries, lower than 20, and not significantly different from 13. In 8th grade science, the United States scored higher than 15 countries, lower than 9, and not significantly different from 16. When compared to our chief economic partners, the United States is in the bottom half in mathematics and around the middle in science.

The expected performance of individual states on the TIMSS mathematics and science assessments varied widely. In mathematics, the number of countries that would be expected to outperform a given state ranged from 6 to 38. In science, the number ranged from 1 to 38.

States that earned gold stars for "world-class performance" in mathematics and science are shown on the map in Figure 2. Stars were awarded to states that would be expected to score as well as, or better than, 40 or more of the 41 participating TIMSS nations in mathematics or science. The maximum number of stars that a state can earn for world-class performance is two (one in mathematics and one in science), although no state earned a star in mathematics. Colorado would be expected to score as well as, or better than, 27 nations in mathematics and 40 nations in science.

In science, 14 states earned a star for world-class performance, including Colorado. Students in only one nation – Singapore – would be expected to outperform the 8th graders in these states in science:

1. Colorado
2. Connecticut
3. Iowa
4. Maine
5. Massachusetts
6. Minnesota
7. Montana
8. Nebraska
9. North Dakota
10. Oregon
11. Utah
12. Vermont
13. Wisconsin
14. Wyoming

Conclusions

Is Colorado making progress toward Goal 3 of the National Education Goals by increasing student achievement in mathematics and science? We cannot answer this question for science yet because NAEP has assessed science only once at the state level. However, in mathematics the answer is "yes." The majority of states that participated in NAEP assessments during the 1990s, including Colorado, have shown significant improvements in student academic achievement in mathematics in at least one grade. Colorado was one of twenty-eight states that earned at least one star (out of a possible two) for improvement over time, and one of six states that earned two. From this perspective, Colorado has moved closer to the Goal in mathematics.

How close is Colorado to achieving the world-class levels of performance in mathematics and science indicated in Goal 5? Results of the NAEP/TIMSS linking study suggest that no state would likely place first in the world in mathematics. States with the highest NAEP scores in the nation would be expected to trail at least six countries if they were to take the TIMSS assessment, and Colorado would be expected to fall in the middle of the group of countries. But in 8th grade science, Colorado would be among the best, placing among the 14 states that would be expected to achieve world-class levels of performance.

The challenge before us now is to increase momentum – to accelerate student academic progress in more states, in more subject areas, in more grades, and among all students. The National Education Goals Panel will continue to monitor state progress as new state-level NAEP assessments are administered in reading, writing, mathematics, and science between now and the end of the decade, and in 1999, when the international TIMSS mathematics and science assessments are scheduled to be repeated in approximately 40 countries. Future Goals Panel reports will describe educational programs and policies implemented by states that have made significant progress in raising student academic achievement. This information will be available on the Goals Panel's Web site, www.negp.gov, as part of a series of reports on promising state practices.

The National Education Goals Panel remains convinced that states want and need good information that will help them gauge the success of their education improvement efforts. This document shows three ways in which NAEP and TIMSS data can help state policymakers measure their state's progress toward Goals 3 and 5:

- by monitoring educational progress over time;
- by benchmarking their students' academic performance against the best in the nation and the best in the world; and
- by monitoring the extent to which all groups of students in their state are achieving at high levels.

The Goals Panel strongly encourages Colorado and all other states to continue participating in NAEP assessments and to consider participating in the next administration of TIMSS, so that policymakers and the public can determine whether educational programs and policies are producing the desired results – students who are competent, knowledgeable, and capable.

Data Sources

Mathematics

Reese, C.M., Miller, K.E., Mazzeo, J., & Dossey, J.A. (1997, February). *NAEP 1996 mathematics report card for the nation and the states.* Washington, DC: National Center for Education Statistics.

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Johnson, E.G., & Siegendorf, A. (1998, May). *Linking the National Assessment of Educational Progress and the Third International Mathematics and Science Study: Eighth grade results.* Report prepared for the U.S. Department of Education, National Center for Education Statistics, NCES 98-500, Washington, DC: U.S. Government Printing Office.

Colorado

Mathematics Grade 4

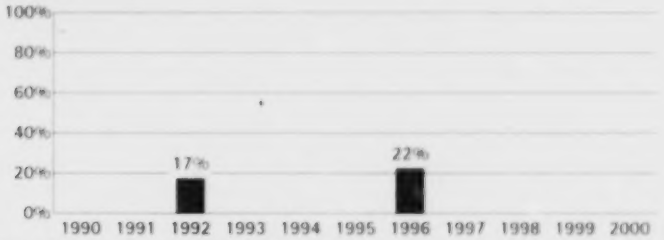
1. Improvement Over Time

Have Colorado's 4th graders improved in mathematics achievement?

Yes. The percentage of Colorado's public school 4th graders who met the Goals Panel's performance standard in mathematics increased from 17% in 1992, to 22% in 1996.

The Goals Panel has set its performance standard at the two highest levels of achievement – Proficient or Advanced – on the National Assessment of Educational Progress, or NAEP.

Percentage of public school 4th graders at or above Proficient on the NAEP mathematics assessment



Mathematics performance will be tested again in 2000

2. State Comparisons[1]

How did Colorado compare with other states in 4th grade mathematics achievement in public schools in 1996?

2 states had significantly higher[2] percentages of students who were at or above Proficient on NAEP:

Connecticut	31%	Minnesota	29%

24 states had similar[2] percentages of students who were at or above Proficient on NAEP:

Maine, Wisconsin	27%	***Colorado***, Iowa, Maryland, Montana	**22%**
New Jersey, Texas	25%	***U.S.***,* Alaska, North Carolina, Oregon, Washington	**21%**
Indiana, Massachusetts, Nebraska, North Dakota	24%	Missouri, New York, Pennsylvania	20%
Michigan, Utah, Vermont	23%	Virginia, West Virginia, Wyoming	19%

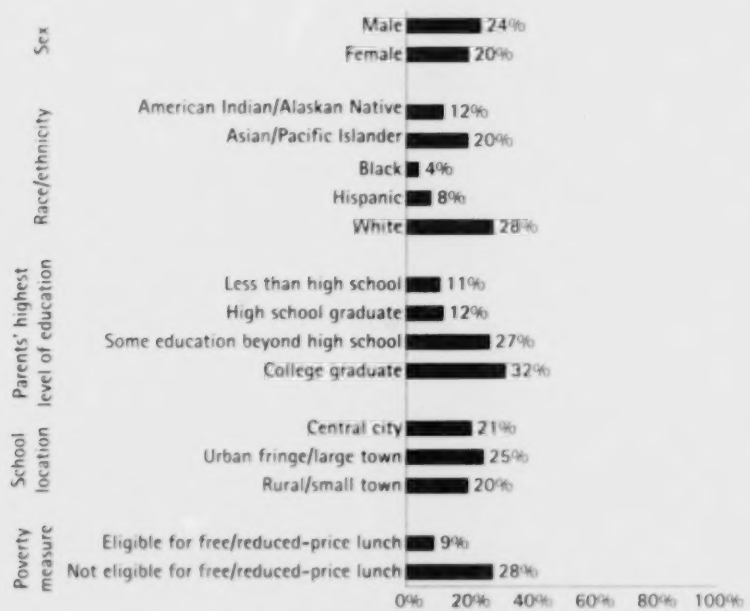
18 states had significantly lower[2] percentages of students who were at or above Proficient on NAEP:

Rhode Island, Tennessee	17%	South Carolina	12%
Delaware, Hawaii, Kentucky	16%	Alabama, California	11%
Arizona, Florida	15%	Louisiana, Mississippi	8%
Nevada	14%	District of Columbia	5%
Arkansas, Georgia, New Mexico	13%	Guam	3%

[1] The term "state" is used to refer to the 50 states, the District of Columbia, and the territories.
[2] See explanation on p. 3.
* Figure shown for the U.S. includes both public and nonpublic school data.

3. Subgroup Performance

What percentages of public school 4th graders in different subgroups in Colorado were at or above Proficient on the 1996 NAEP mathematics assessment?



[1] Interpret differences between subgroups with caution. See p. 14.

Mathematics Grade 8 — Colorado

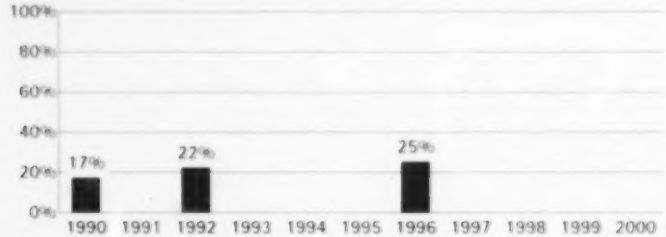
1. Improvement Over Time

Have Colorado's 8th graders improved in mathematics achievement?

Yes. The percentage of Colorado's public school 8th graders who met the Goals Panel's performance standard in mathematics increased from 17% in 1990, to 25% in 1996.

The Goals Panel has set its performance standard at the two highest levels of achievement – Proficient or Advanced – on the National Assessment of Educational Progress, or NAEP.

Percentage of public school 8th graders at or above Proficient on the NAEP mathematics assessment



Mathematics performance will be tested again in 2000.

2. State Comparisons[1]

How did Colorado compare with other states in 8th grade mathematics achievement in public schools in 1996?

8 states had significantly higher[2] percentages of students who were at or above Proficient on NAEP:

Minnesota	34%	Montana, Wisconsin	32%
North Dakota	33%	Connecticut, Iowa, Maine, Nebraska	31%

13 states had similar[2] percentages of students who were at or above Proficient on NAEP:

Alaska	30%	***Colorado***	**25%**
Massachusetts, Michigan	28%	***U.S.**** Indiana, Maryland, Utah	**24%**
Vermont	27%	Mi[illegible], New York, Wyoming	22%
Oregon, Washington	26%	Texa[illegible]	21%

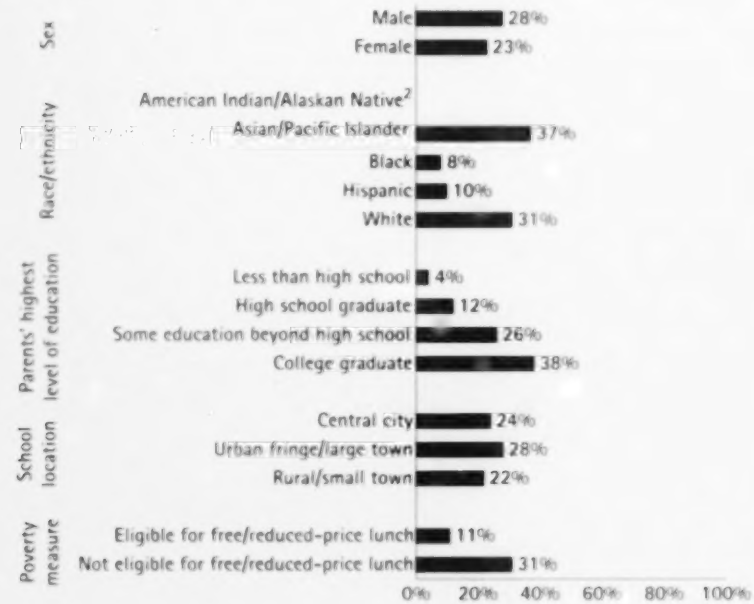
20 states had significantly lower[2] percentages of students who were at or above Proficient on NAEP:

Virginia	21%	New Mexico, South Carolina, West Virginia	14%
North Carolina, Rhode Island	20%		
Delaware	19%	Arkansas	13%
Arizona	18%	Alabama	12%
California, Florida	17%	Louisiana, Mississippi	7%
Georgia, Hawaii, Kentucky	16%	Guam	6%
Tennessee	15%	District of Columbia	5%

[1] The term "state" is used to refer to the 50 states, the District of Columbia, and the territories.
[2] See explanation on p. 3.
[3] State may appear to be out of place. However, statistically, its placement is correct.
* Figure shown for the U.S. includes both public and nonpublic school data.

3. Subgroup Performance

What percentages of public school 8th graders in different subgroups[1] in Colorado were at or above Proficient on the 1996 NAEP mathematics assessment?



[1] Interpret differences between subgroups with caution. See p. 14.
[2] Characteristics of the sample do not permit a reliable estimate.

Colorado

Science Grade 8

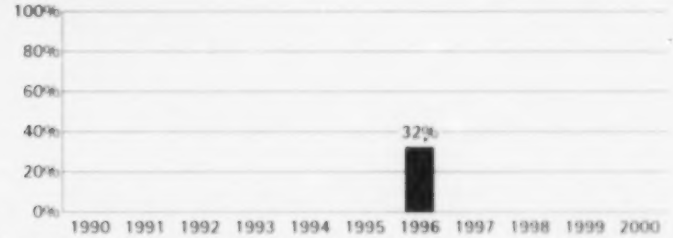
1. Improvement Over Time

Have Colorado's 8th graders improved in science achievement?

In 1996, 32% of Colorado's public school 8th graders met the Goals Panel's performance standard in science. The Goals Panel will report whether science performance has improved over time when science is assessed again in 2000.

The Goals Panel has set its performance standard at the two highest levels of achievement – Proficient or Advanced – on the National Assessment of Educational Progress, or NAEP.

Percentage of public school 8th graders at or above Proficient on the NAEP science assessment



Science performance will be tested again in 2000.

2. State Comparisons†

How did Colorado compare with other states in 8th grade science achievement in public schools in 1996?

4 states had significantly higher[1] percentages of students who were at or above Proficient on NAEP:			
Maine, Montana, North Dakota	41%	Wisconsin	39%

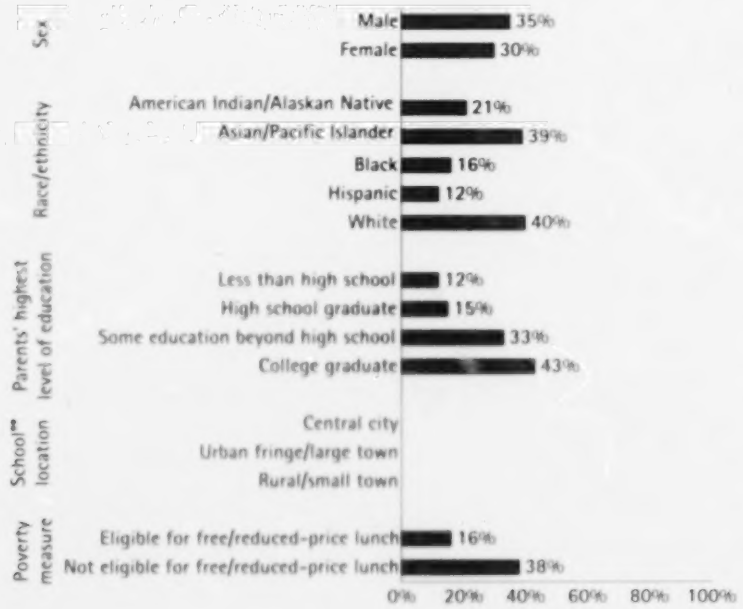
14 states had similar[1] percentages of students who were at or above Proficient on NAEP:			
Massachusetts, Minnesota	37%	Alaska	31%
Connecticut, Iowa	36%	Indiana	30%
Nebraska	35%	***U.S.****	**29%**
Vermont, Wyoming	34%	Missouri	28%
Colorado, Michigan, Oregon, Utah	**32%**	Virginia	27%

23 states had significantly lower[1] percentages of students who were at or above Proficient on NAEP:			
New York,[2] Washington[2]	27%	New Mexico	19%
Rhode Island	26%	Alabama	18%
Maryland	25%	South Carolina	17%
North Carolina	24%	Hawaii	15%
Arizona, Kentucky, Texas	23%	Louisiana	13%
Arkansas, Tennessee	22%	Mississippi	12%
Delaware, Florida, Georgia, West Virginia	21%	Guam	7%
California	20%	District of Columbia	5%

† The term "state" is used to refer to the 50 states, the District of Columbia, and the territories.
1 See explanation on p. 3.
2 State may appear to be out of place, however, statistically, its placement is correct.
* Figure shown for the U.S. includes both public and nonpublic school data.

3. Subgroup Performance

What percentages of public school 8th graders in different subgroups† in Colorado were at or above Proficient on the 1996 NAEP science assessment?



† Interpret differences between subgroups with caution. See p. 14.
** No school location data for science in 1996.

Mathematics Grade 8

Forty-one nations[1] participated in the Third International Mathematics and Science Study (TIMSS) in 8th grade mathematics in 1995. If public school 8th graders in Colorado participated in the TIMSS mathematics assessment, how would their average performance compare to that of students who took TIMSS in these nations?

14 nations[1] would be expected to perform significantly higher:[1]

(Austria)
Belgium – Flemish[2]
(Bulgaria)
Czech Republic
France
Hong Kong
Hungary
Japan
Korea
(Netherlands)
Singapore
Slovak Republic
(Slovenia)
(Switzerland)

17 nations[1] would be expected to perform similarly:[1]

(Australia)
(Belgium – French)[2]
Canada
Colorado
(Denmark)
(England)
(Germany)
Iceland
Ireland
(Israel)
(Latvia – LSS)[3]
New Zealand
Norway
Russian Federation
(Scotland)
Sweden
(Thailand)
United States

10 nations[1] would be expected to perform significantly lower:[1]

(Colombia)
Cyprus
(Greece)
Iran, Islamic Republic
(Kuwait)
(Lithuania)
Portugal
(Romania)
(South Africa)
Spain

[1] The term "nation" is used to refer to nations, states, or jurisdictions. Performance for nations is based on public school data only. Nations not meeting international guidelines are shown in parentheses.
[1] See explanation on p. 3.
[2] The Flemish and French educational systems in Belgium participated separately.
[3] Latvia is designated LSS because only Latvian-speaking schools were tested, which represent less than 65% of the population.

Science Grade 8 ☆

Forty-one nations[1] participated in the Third International Mathematics and Science Study (TIMSS) in 8th grade science in 1995. If public school 8th graders in Colorado participated in the TIMSS science assessment, how would their average performance compare to that of students who took TIMSS in these nations?

1 nation[1] would be expected to perform significantly higher:[1]

Singapore

20 nations[1] would be expected to perform similarly:[1]

(Australia)
(Austria)
Belgium – Flemish[2]
(Bulgaria)
Canada
Colorado
Czech Republic
(England)
(Germany)
Hungary
Ireland
(Israel)
Japan
Korea
(Netherlands)
New Zealand
Russian Federation
Slovak Republic
(Slovenia)
Sweden
United States

20 nations[1] would be expected to perform significantly lower:[1]

(Belgium – French)[2]
(Colombia)
Cyprus
(Denmark)
France
(Greece)
Hong Kong
Iceland
Iran, Islamic Republic
(Kuwait)
(Latvia – LSS)[3]
(Lithuania)
Norway
Portugal
(Romania)
(Scotland)
(South Africa)
Spain
(Switzerland)
(Thailand)

[1] The term "nation" is used to refer to nations, states, or jurisdictions. Performance for nations is based on public school data only. Nations not meeting international guidelines are shown in parentheses.
[1] See explanation on p. 3.
[2] The Flemish and French educational systems in Belgium participated separately.
[3] Latvia is designated LSS because only Latvian-speaking schools were tested, which represent less than 65% of the population.

Colorado

Statistically Significant Differences in Subgroup Performance on NAEP

This page of the report provides additional information about the student subgroups in Colorado profiled in Part 3 on the state pages. Part 3 shows the percentages of public school students in different subgroups who met the Goals Panel's performance standard (that is, a score at or above the Proficient level) on the most recent NAEP mathematics and science assessments. Results are presented by sex, race/ethnicity, parents' highest level of education, school location, and eligibility for free/reduced-price lunch programs.

Pairs of subgroups are listed only if the percentage of students in one group who scored at or above Proficient was significantly higher than that of students in a second group. (See explanation of statistical significance on p. 3.) This is shortened to read, for example, males outperformed females. If a particular pair of subgroups is not shown, either the differences between them were not statistically significant, or sample sizes were too small to permit reliable estimates. The reader is cautioned to avoid interpreting these subgroup differences as causal relationships.

Mathematics, Grade 4 – 1996

- Whites outperformed American Indians/Alaskan Natives, Blacks, and Hispanics.
- Asians/Pacific Islanders outperformed Blacks and Hispanics.
- Students whose parents (a) had some education beyond high school, or (b) completed college outperformed students whose parents did not complete high school.
- Students who *were not* eligible for the free/reduced-price school lunch program outperformed students who *were* eligible.

Mathematics, Grade 8 – 1996

- Males outperformed females.
- Whites and Asians/Pacific Islanders outperformed Blacks and Hispanics.
- Students whose parents (a) had some education beyond high school, or (b) completed college outperformed students whose parents did not complete high school.
- Students who *were not* eligible for the free/reduced-price school lunch program outperformed students who *were* eligible.

Science, Grade 8 – 1996

- Males outperformed females.
- Whites outperformed American Indians/Alaskan Natives, Blacks, and Hispanics.
- Asians/Pacific Islanders outperformed Blacks and Hispanics.
- Students whose parents (a) had some education beyond high school, or (b) completed college outperformed students whose parents did not complete high school.
- Students who *were not* eligible for the free/reduced-price school lunch program outperformed students who *were* eligible.

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1. For what purpose do you use this report?

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3. How, if at all, could the report have served you better?

4. How do you rate the usefulness of the information included on the state data pages?

(1 = not very useful and 5 = very useful)

- Part 1 - Improvement Over Time

1 2 3 4 5 N/A

- Part 2 - State Comparisons

1 2 3 4 5 N/A

- Part 3 - Subgroup Performance

1 2 3 4 5 N/A

- International Comparisons

1 2 3 4 5 N/A

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